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# ONE

ONTARIO'S NIAGARA ESCARPMENT



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MONITORING PROGRAM

# ONE SPECIAL PLACE ONTARIO'S NIAGARA ESCARPMENT

Ontario's Niagara Escarpment is one of Canada's most scenic landforms. The geological, climatic and ecological conditions of the area have created *one* special place, dominated by a cuesta extending for approximately 725 kilometres from Queenston near Niagara Falls to Tobermory at the tip of the Bruce Peninsula. The same feature extends beyond Tobermory and continues under the waters of Lake Huron only to reappear on the nearby islands of Fathom Five National Marine Park and Manitoulin Island.

The Escarpment and its environs contain a diversity of micro-climates created by the dramatic changes in relief across the scarp system, the orientation of cliff and talus, cold air drainage conditions along valleys, and the presence of rock openings and springs. As a result of the landform and micro-climatic diversity, the Niagara Escarpment consists of an extremely rich complex of plant and animal communities.

The Niagara Escarpment Parks System, together with private lands along the Niagara Escarpment, constitute the largest continuous forested area in southern Ontario. This ribbon of near wilderness is an essential wildlife refuge for plants and animals in the heart of Canada's most developed region.

# A FIRST - ONTARIO'S NIAGARA ESCARPMENT (ONE) MONITORING PROGRAM

The Niagara Escarpment Plan (NEP) came into effect in 1985 and is Canada's first large scale environmental land use plan. The Plan implements the Niagara Escarpment Planning and Development Act (NEPDA) which was created "to provide for the maintenance of the Niagara Escarpment and land in its vicinity substantially as a continuous natural environment, and to ensure only such development occurs as is compatible with that natural environment".

The ONE Monitoring Program, another first for the Niagara Escarpment, has been launched to answer the following question.

Is the Plan, with its unique set of environmental land use policies, actually achieving its goal and objectives?

The ONE Monitoring Program is unique because it focuses on the Niagara Escarpment as a living and interconnected landscape. The Program is designed to assess whether the policies of the NEP are working and examines the linkages between land use change and ecosystem status. Very few monitoring programs anywhere have been designed to assess these linkages.

Unlike traditional monitoring approaches that focus on one aspect of the environment eg. air, land, water or single contaminant sources, the ONE Monitoring Program utilizes a suite of indicators designed to measure the effectiveness of NEP policies by monitoring ecosystem components and multiple land use activities.

## THE BIOSPHERE RESERVE CONNECTION

*Ontario's Niagara Escarpment, Ecuador's Galapagos Islands and Tanzania's Serengeti are all internationally significant ecosystems and World Biosphere Reserves.*

Biosphere Reserves are designated by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Man and the Biosphere (MAB) Programme. In 1990, Ontario's portion of the Niagara Escarpment received this very prestigious designation. The Niagara Escarpment is one of six Biosphere Reserves in Canada and over 300 world wide.

The long-range goal of the MAB Programme is to create an international network of Reserves to include examples of all the earth's main ecological systems with their different patterns of human use and adaptations to them.

Fully functioning Biosphere Reserves:

- i) conserve landscapes, ecosystems, species and genetic variation;
- ii) foster economic development which is ecologically and culturally sustainable; and
- iii) provide support for research, monitoring, education and training related to local, regional, national and global conservation and sustainable development issues.

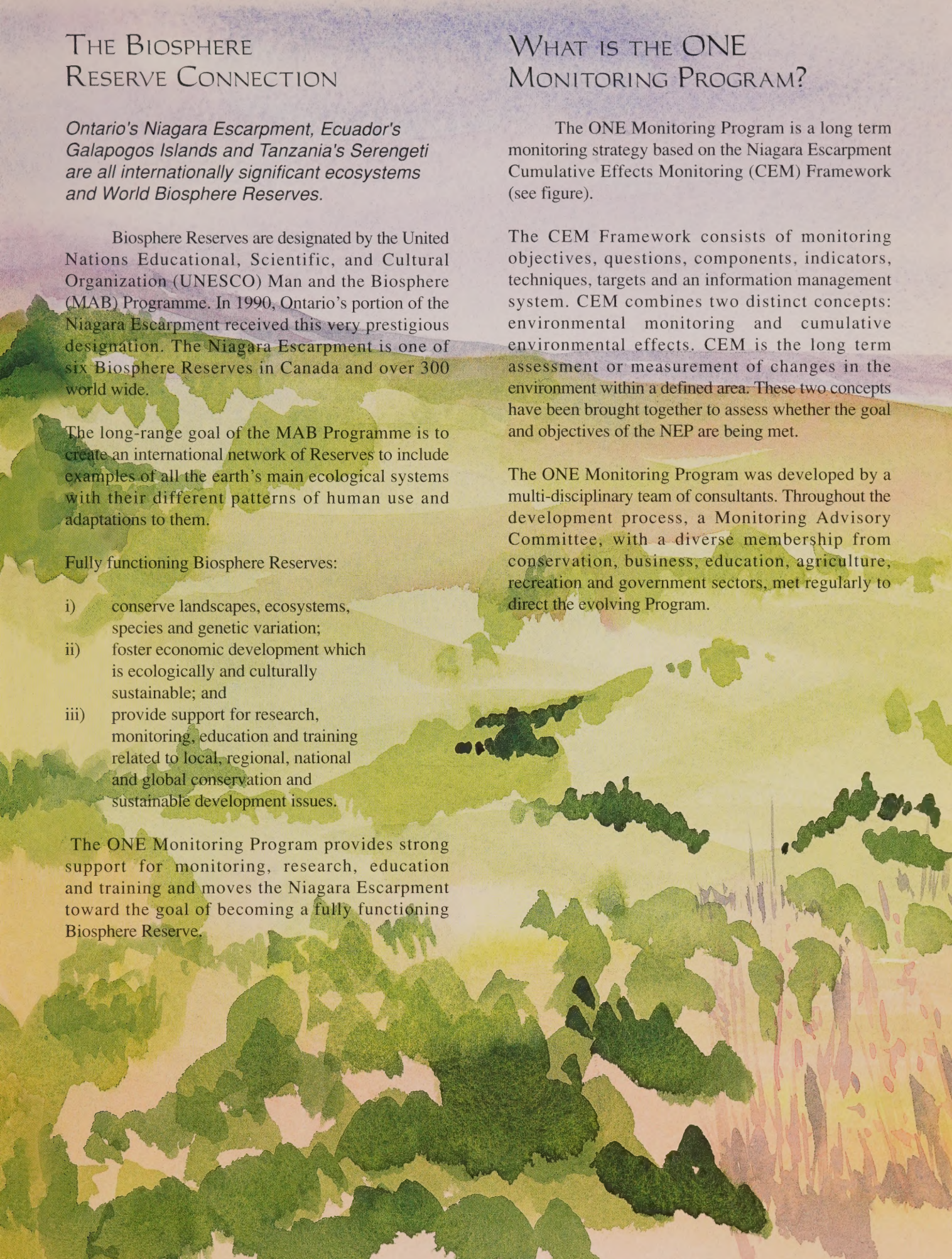
The ONE Monitoring Program provides strong support for monitoring, research, education and training and moves the Niagara Escarpment toward the goal of becoming a fully functioning Biosphere Reserve.

## WHAT IS THE ONE MONITORING PROGRAM?

The ONE Monitoring Program is a long term monitoring strategy based on the Niagara Escarpment Cumulative Effects Monitoring (CEM) Framework (see figure).

The CEM Framework consists of monitoring objectives, questions, components, indicators, techniques, targets and an information management system. CEM combines two distinct concepts: environmental monitoring and cumulative environmental effects. CEM is the long term assessment or measurement of changes in the environment within a defined area. These two concepts have been brought together to assess whether the goal and objectives of the NEP are being met.

The ONE Monitoring Program was developed by a multi-disciplinary team of consultants. Throughout the development process, a Monitoring Advisory Committee, with a diverse membership from conservation, business, education, agriculture, recreation and government sectors, met regularly to direct the evolving Program.



# Niagara Escarpment Cumulative Effects Monitoring Framework

## Monitoring Objectives

Terrestrial Ecology	Water	Recreation	Open Landscape Character	Land Use	Public Access
Natural processes and habitats? Regenerating fields and former aggregate areas?	Quality and quantity of groundwater? Quality and quantity of surface water?	Recreational activities and opportunities? Recreational demands and carrying capacities?	Open Landscape character?	Permitted uses and activities? Permitted land management practices?	Road access and trail access? Stress on access points?
Cliff face, valleys, forests, wetlands	Streams, ponds, groundwater	Public & private parks, conservation areas	Access points, walking trails	Designated areas, land use classes	Landform, vegetation, views, land use, heritage

## Indicators

## Targets

## Techniques

## Information Management

## Analysis and reporting

## Management Actions

A unique Monitoring Framework was developed specifically for the ONE Monitoring Program to operationalize the CEM concept. The CEM Framework includes:

**MONITORING OBJECTIVES:** taken directly from the NEP, the objectives address: terrestrial ecology, water, recreation, open landscape character, land use and public access.

**MONITORING QUESTIONS:** developed for each objective, the questions are designed to translate the monitoring objectives into queries which the monitoring program is to help answer.

**MONITORING COMPONENTS:** those parts of the environment to be monitored, eg. wetlands, cliff face, land use.

**MONITORING INDICATORS:** substitute measures of the monitoring components, eg. species, forest fragmentation, water quality.

**MONITORING TECHNIQUES:** methods for measuring the indicators, eg. Landsat land use classification, air photo interpretation, species presence/absence monitoring.

**MONITORING TARGETS:** quantitative and qualitative criteria to help define the significance of measured indicators.

**INFORMATION MANAGEMENT:** including analysis and reporting capabilities.

Another important aspect of the CEM Framework is "scale". Monitoring takes place at a range of scales from regional to site specific.

Comparative monitoring between areas experiencing human impacts and less developed areas is also undertaken. Such comparative monitoring will achieve a better understanding of the relationship between human impacts and their effects on the natural environment.

# IMPLEMENTATION OF THE ONE MONITORING PROGRAM

The ONE Monitoring Program is administered by the Niagara Escarpment Commission (NEC) and was developed as a joint effort with the Ministry of Environment and Energy (MOEE).

The ONE Monitoring Program:

- i) has received monitoring data from a number of completed projects including information on land use change and forest fragmentation trends, and forest biodiversity;
- ii) is actively involved in a number of ongoing monitoring projects including forest biodiversity plot establishment, Landsat analysis, and monitoring protocol development and testing; and
- iii) is facilitating new monitoring initiatives with academic, non-governmental organizations and government agencies.

*The following are examples of monitoring projects completed or under way.*

## LANDSAT ANALYSIS OF THE NIAGARA ESCARPMENT

Data from satellite imagery is now available showing land use change and forest fragmentation from 1975 to 1995. The data presents information on a regional scale never before provided for the Niagara Escarpment.

Data on land use trend information for the entire southern portion of the Escarpment along with five sub-regions has been generated.

Forest fragmentation results indicate that as development progresses there are two main impacts on forests: a loss of connectivity between forest areas; and a decrease in the size of remaining forest blocks. These changes are potentially significant ecological impacts.

## BIODIVERSITY MONITORING

In partnership with the Ecological Monitoring and Coordinating Office, Environment Canada, the MOEE and the NEC are monitoring forest biodiversity utilizing the Smithsonian Institution (SI)/MAB Forest Biodiversity Protocol.

These monitoring activities are part of Environment Canada's Ecological Monitoring and Assessment Network (EMAN). EMAN focuses on: understanding and protecting the integrity of Canada's ecosystems, monitoring and restoring their natural biological diversity, assessing the impacts of stresses such as climate change and acid rain, stewardship, and improving the ability to make good environmental decisions. EMAN will provide the ONE Monitoring Program with access to national monitoring expertise and comparable monitoring data elsewhere in Canada.

Two SI/MAB plots (Hilton Falls Conservation Area Plot and Hockley Valley Nature Reserve Plot) were established in the summer of 1996 and incorporated into the ONE Monitoring Program network of sites. SI/MAB plots will become a foundation for future monitoring associated with the ONE Monitoring Program and will generate extensive research interest. Monitoring plots will be established in selected physiographic regions of the Escarpment.

## LANDSCAPE CUMULATIVE EFFECTS MONITORING

Research through the NEC and the University of Waterloo has resulted in the development of a landscape approach to measure and monitor the cumulative effects of land use change on the natural (terrestrial) landscape. The approach uses a land use and forested area classification system, together with a suite of measures and indicators of "landscape naturalness" to evaluate the nature and extent of change over a twenty year period.

Initial results for the Halton area of the Niagara Escarpment indicate that there has been a significant increase in forest fragmentation, despite the slight increase in total forested area. The landscape approach method is available for application to other areas along the Niagara Escarpment.

## CLIFF ECOLOGY MONITORING

The Cliff Ecology Research Group, University of Guelph, has been undertaking scientific exploration of the Niagara Escarpment for 10 years. The Group has translated much of their scientific research on the old growth cedars of the Niagara Escarpment into monitoring protocols for the ONE Monitoring Program.

The Cliff Ecology Research Group has also reported extensive baseline inventory data associated with five sites within the Halton region of the Niagara Escarpment. The Research Group has discovered that the trees of the Escarpment contain information on the frequency and magnitude of natural climatic change. This is important information to have in the context of global concerns about human induced climate change.

The importance of these data sets is obvious considering that the old growth forest occurring on the cliffs of the Niagara Escarpment are the most significant in Eastern North America.

## UPPER BRUCE PENINSULA MONITORING

Parks Canada, in partnership with various government agencies and academic institutions, has initiated the development of an Ecological Integrity Monitoring Program for the Upper Bruce Peninsula Region. The purpose of this program is to provide an on-going mechanism to assess the overall health of the Upper Bruce Peninsula ecosystem over time. This Parks Canada program supports Niagara Escarpment Biosphere Reserve objectives and builds upon existing monitoring initiatives.

The partnership provides the ONE Monitoring Program with access to technical expertise, extensive geographical information coverage of the north Bruce Peninsula Region and data from well established Bruce Peninsula National Park and Fathom Five National Marine Park monitoring programs. The National Park has also established the most northerly SI/MAB Forest Biodiversity Plot on the Niagara Escarpment located at the Emmett Lake Research Station.

The integration of the Upper Bruce Peninsula Ecological Integrity Monitoring Program, other Parks Canada monitoring initiatives, and the ONE Monitoring Program will provide partners with opportunities to improve ecosystem planning and conservation across jurisdictional boundaries on a regional scale.

## UNIVERSITY OF WATERLOO NIAGARA ESCARPMENT MONITORING COURSE

The University of Waterloo, MOEE and NEC have established a Niagara Escarpment Monitoring Field Course (first session was held during the summer term of 1996). The course provides University students with an opportunity to gain valuable field experience.

Future course sessions will focus on Forest Biodiversity (SI/MAB) plots located in the Hilton Falls Conservation Area (Halton Region) and the Hockley Valley Nature Reserve (Mono Township).

"Barrow Bay", Bruce Peninsula

## MONITORING THE EFFECTS OF POND CONSTRUCTION, WATER TAKING AND DIVERSION

The NEC has completed a study investigating the environmental effects of pond construction, water taking and diversion. The study areas included Silver Creek and Rogers Creek within the Credit River Watershed and portions of the Nottawassaga River Watershed in the Townships of Clearview and Mono. Sampling has been ongoing for two years and periodic sampling will continue in an effort to build a long term data base. The study also makes recommendations on future monitoring initiatives and protocols.

## FOREST BIRD MONITORING PROGRAM

The Canadian Wildlife Service (CWS) has been monitoring birds on the Niagara Escarpment for many years through a number of programs including the Forest Bird Monitoring Program (FBMP).

The CWS is working toward the establishment of further FBMP sites on the Escarpment. To date, 35 FBMP sites have been established. The CWS has also provided scientific assistance to the ONE Monitoring Program through field reconnaissance work during the siting of ONE monitoring plots. Plots have been located adjacent to FBMP sites to take advantage of existing bird monitoring records.

## COMMUNITY PARTNERSHIP, EDUCATION AND ENVIRONMENTAL MONITORING

The Association for Canadian Educational Resources (ACER) and the Council of Outdoor Educators of Ontario (COEO), in partnership with outdoor education centres along the Niagara Escarpment and government agencies (twelve program partners in total), have secured funding for a two year monitoring project focussed on community partnerships and education.

The project is designed to strengthen environmental protection in the Niagara Escarpment Biosphere Reserve by establishing an integrated, long term environmental education, monitoring and research network that is community based and that links

citizens, educators, researchers and environmental and land use agencies.

The project will also result in up to six SI/MAB plots being established in association with the Bruce County Outdoor Education Centre, Boyne River Natural Science School and the Royal Botanical Gardens.

## MONITORING RESOURCES

### *ONE Monitoring Committee*

A ONE Monitoring Committee has been established to assist potential partners with the following activities:

- i) monitoring design;
- ii) networking;
- iii) acquiring background monitoring and research data;
- iv) monitoring permit requirements;
- v) securing funding; and
- vi) data storage, analysis and reporting.

## ACCESS TO MONITORING DATA

Hard copy and/or digital information is available from the NEC (some copyright restrictions apply).

Existing data includes:

- Mapping information on environmental, planning and cultural themes;
- Landsat data from 1975, 1985 and 1995
- Forest biodiversity monitoring data; and
- Air photos dating from 1975 through 1994.

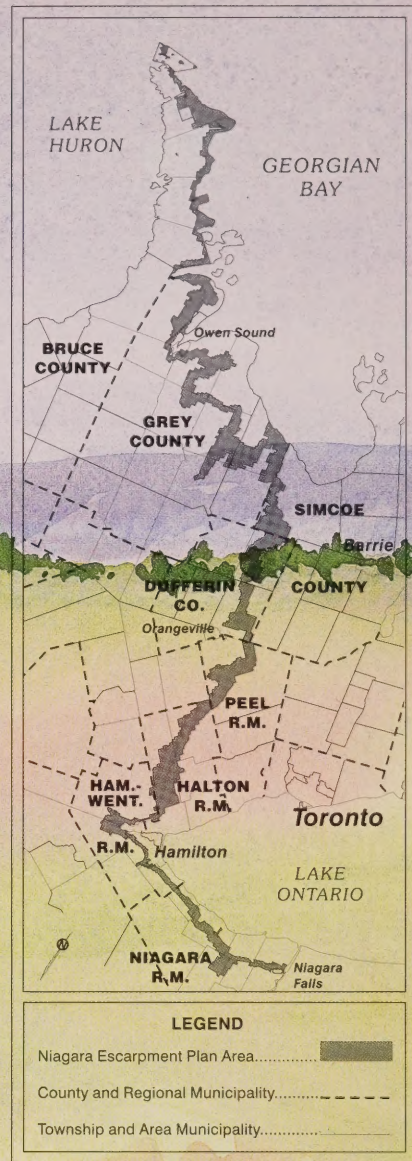
Further data will become available as it is reported to the ONE Monitoring Program.

Monitoring results will be reported through conferences, presentations and periodic publications. Initial monitoring information will focus on the following subjects:

- land use change
- forest cover health, vegetation status
- forest fragmentation and corridor linkages
- disturbances from human activities
- effects of ponds on cold water streams and source areas
- a comprehensive analysis of the old growth cedars of the Escarpment cliffs.
- changes reported through forest bird monitoring
- forest biodiversity data and its role in national and international monitoring initiatives.
- amphibian research

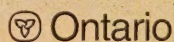
The ONE Monitoring Program needs you!

For more information on the Program, please contact the ONE Monitoring Program at one of the addresses or numbers listed below.



## ONTARIO'S NIAGARA ESCARPMENT (ONE) MONITORING PROGRAM

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ORIGINAL WATERCOLOURS & LAYOUT/DESIGN  
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